

The Nuclear Energy Future

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San Diego, California***

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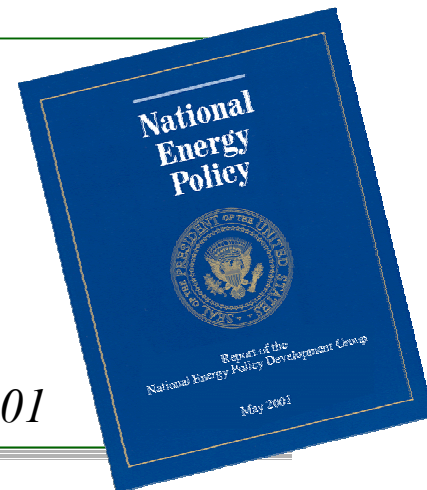
June 2, 2003



The National Energy Policy and Nuclear Power

“The NEPD Group recommends that the President support the expansion of nuclear energy in the United States as a major component of our national energy policy.”

Report of the National Energy Policy Development Group, May 2001



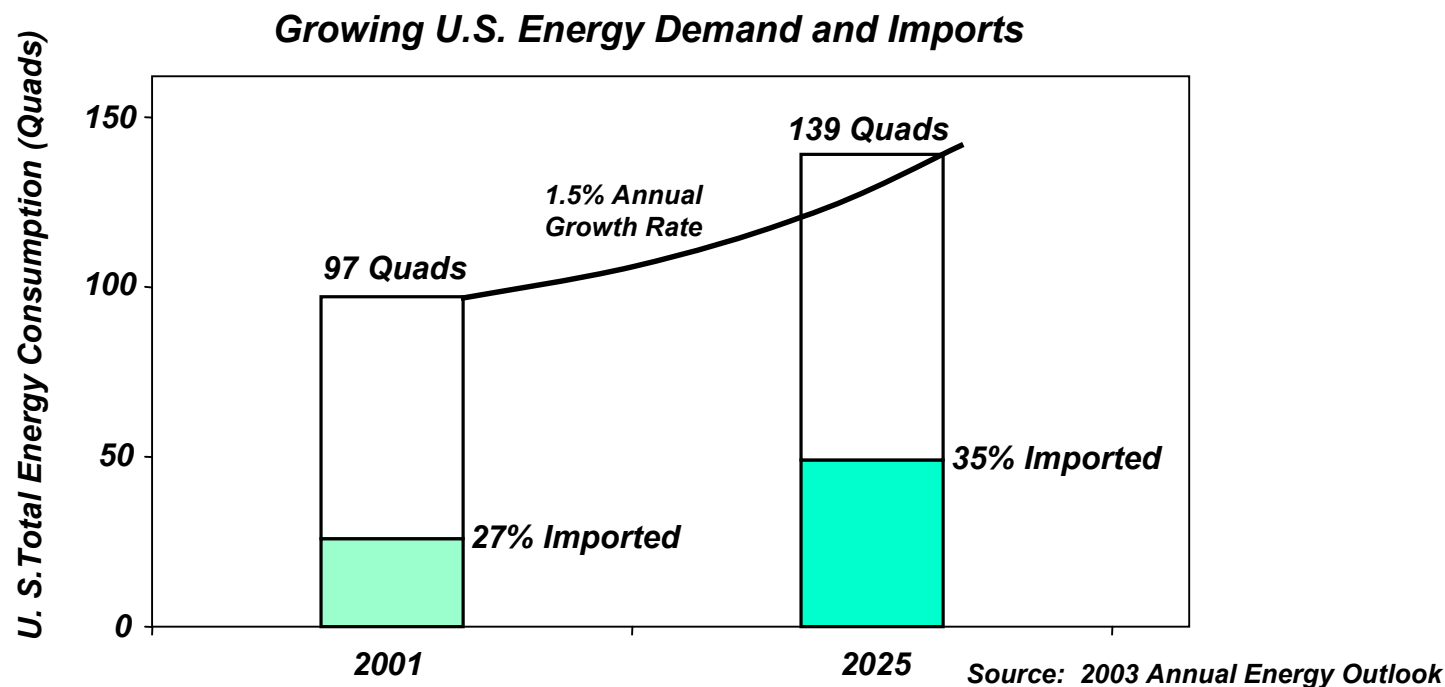
Calvert Cliffs Nuclear Power Plant

Recommendations:

- ◆ Support expansion of nuclear energy in the United States
- ◆ Develop advanced nuclear fuel cycles and next generation technologies
- ◆ Develop advanced reprocessing and fuel treatment technologies



Forecast for Energy Growth

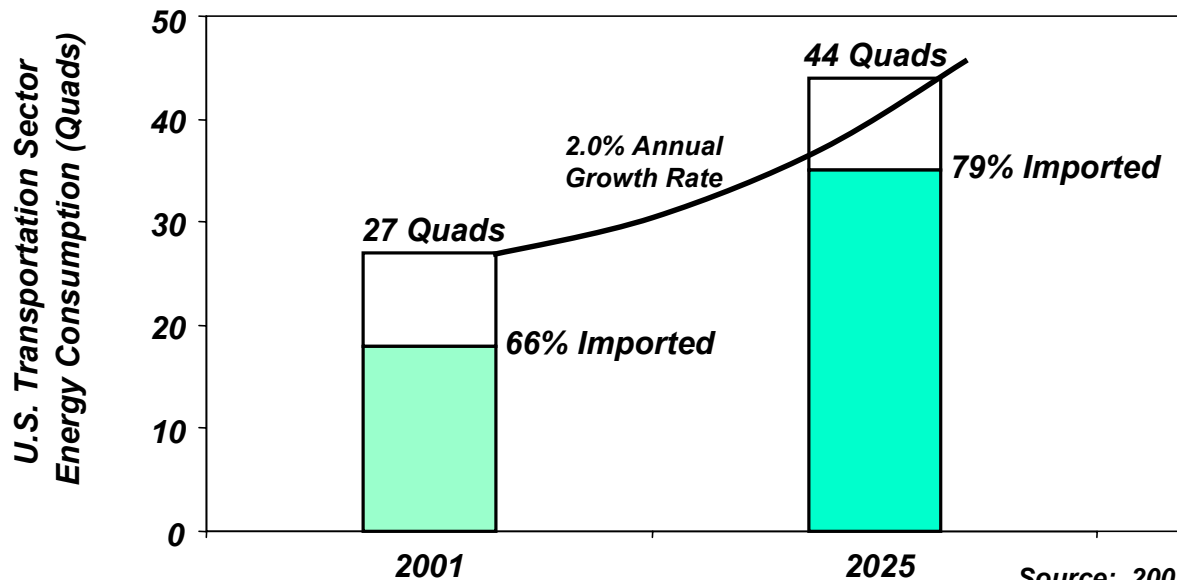


- ◆ Annual outlook is 1.5 percent growth in U.S. energy to 2025
- ◆ Most growth is in natural gas and coal
- ◆ Imports will increase
- ◆ Nuclear can contribute if deployed in the near-term



Energy for Transportation: *A Potential Vulnerability*

Growing U.S. Transportation Sector Energy Demand and Imports



Source: 2003 Annual Energy Outlook

- ◆ Transportation sector is experiencing the fastest growth
- ◆ Outlook is for a large increase in imports
- ◆ Energy security and stability is undermined by increasing reliance on imports



Nuclear Power 2010:

Paving the Way for New Nuclear Power Plants

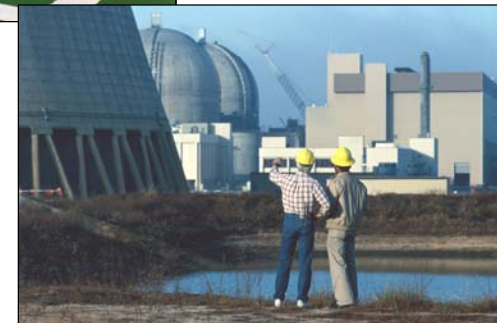
◆ Market Driven, Cost-Shared Approach

- Competitive process -- best proposals win
- Encourage industry to rally around most promising designs

◆ Cooperative Activities

- Early Site Permit (ESP) Application
- Combined Construction and Operating License (COL)
- NRC Design Certification (DC)
- First-of-a-kind engineering for a standardized plant
- Material, component and system testing
- Business Case/Financial

◆ Risk Mitigation Strategy Development



Building New Plants -- A Major Market Challenge

◆ Natural Gas

- How much is there? What price in the future?
- LNG?
- Will investors ever support large base load plants of any kind?

◆ **First few plants will cost more than market will support**

- Would subsequent plants reach vendor estimates?
- Even so, can the market support the long construction times? (4-5 years vs. 18 months for ICCGT)

◆ **Government role?**

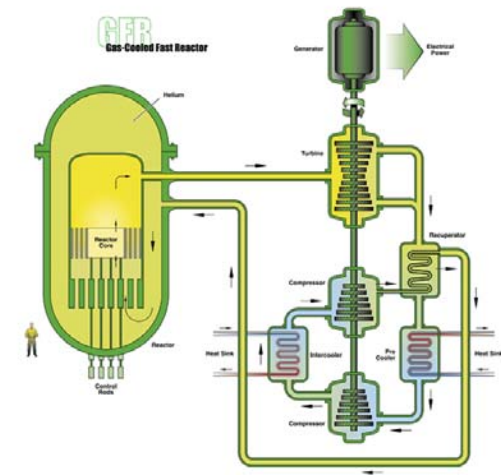
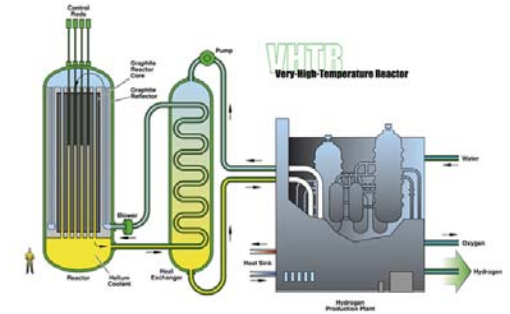
- Why?
- Senate energy proposal



Generation IV Nuclear Energy Systems: *Nuclear Power for a New Century*

**Generation IV International Forum
established in January 2000 to develop:**

- ◆ **Systems that offer significant advances towards:**
 - Sustainability
 - Economics
 - Safety and reliability
 - Proliferation resistance and physical protection
- ◆ **Systems that are deployable by 2030 or earlier**



U.S.A.



United Kingdom



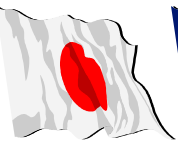
Switzerland



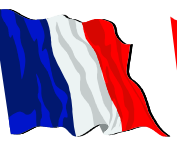
South Korea



South Africa



Japan



France



Canada



Brazil



Argentina



Generation IV Nuclear Energy Systems: *Nuclear Power for a New Century*

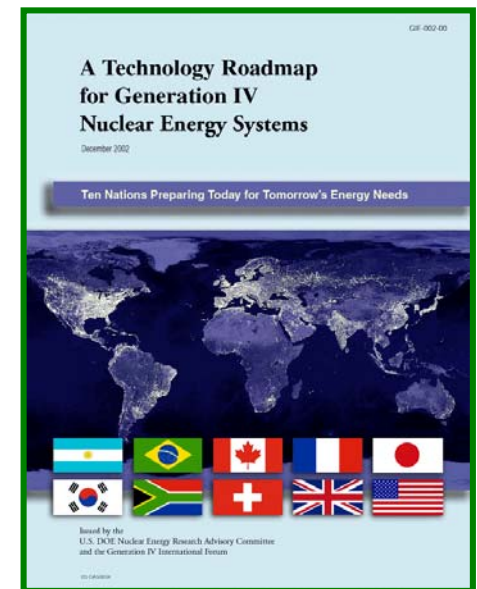
◆ In September 2002, the Generation IV International Forum selected six system concepts for further development:

- Very High Temperature Reactor
- Supercritical Water Cooled Reactor
- Gas Cooled Fast Reactor
- Lead Cooled Fast Reactor
- Sodium Cooled Fast Reactor
- Molten Salt Reactor

◆ In December 2002, the Generation IV Technology Roadmap was issued

- Summarizes and prioritizes the R&D activities necessary to develop the six system concepts

December 2002



<http://nuclear.gov/nerac/FinalRoadmapforNERACReview.pdf>

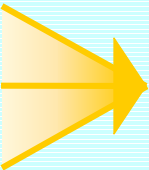


Generation IV Nuclear Energy Systems: *Next Steps/Priorities*

◆ Gen IV “A”

- VHTR → NGNP
- SCWR

◆ Gen IV “B”

- GFR
 - LFR
 - SFR
- 
- U.S. Fast Reactor
?**

Requirements for A Next-Generation Nuclear Plant (NGNP) Project

- Collaborative with international community
- Collaborative with industry -- especially utilities
- Demonstrate H₂ production and advanced electricity
- Result in a commercially viable plant design



Hydrogen:

Nuclear Power for Transportation

- ◆ **President Bush has announced the National Hydrogen Fuel Initiative**
- ◆ **Long-term, a 30 million t/yr U.S. hydrogen supply would be able to replace one-quarter of our gasoline use**
- ◆ **Nuclear energy required for this would be 225 GWth**



The energy from one pound of nuclear fuel could provide the hydrogen equivalent of 250,000 gallons of gasoline without any carbon emissions.



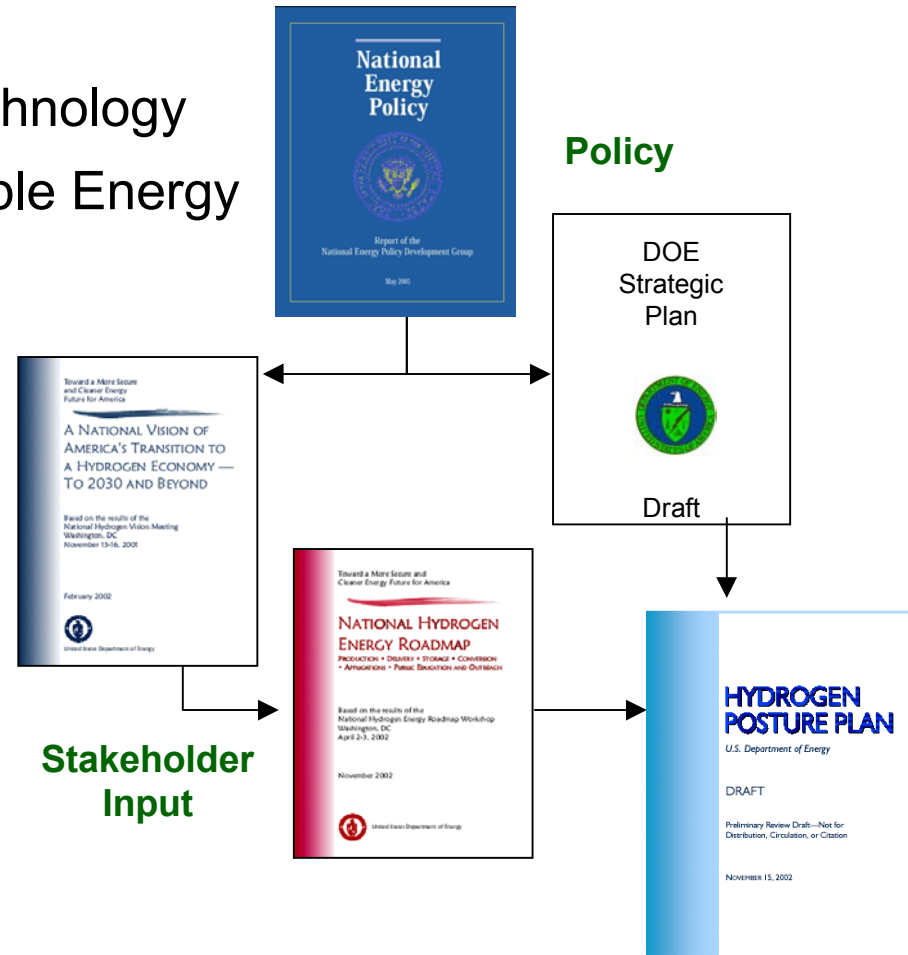
The DOE Hydrogen Program

◆ Integrated DOE program

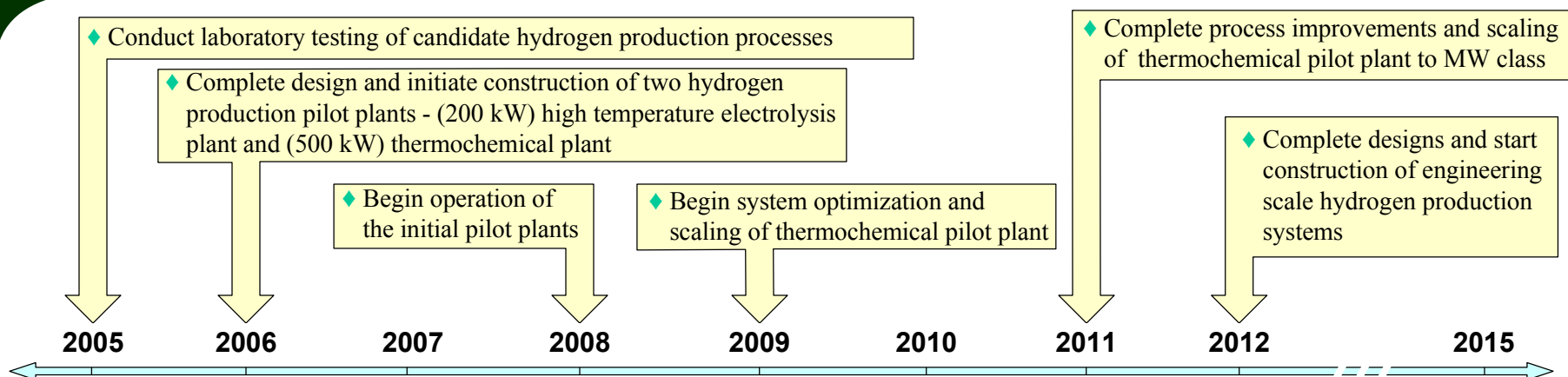
- Nuclear Energy, Science & Technology
- Energy Efficiency and Renewable Energy
- Fossil Energy
- Science

◆ Hydrogen Posture Plan

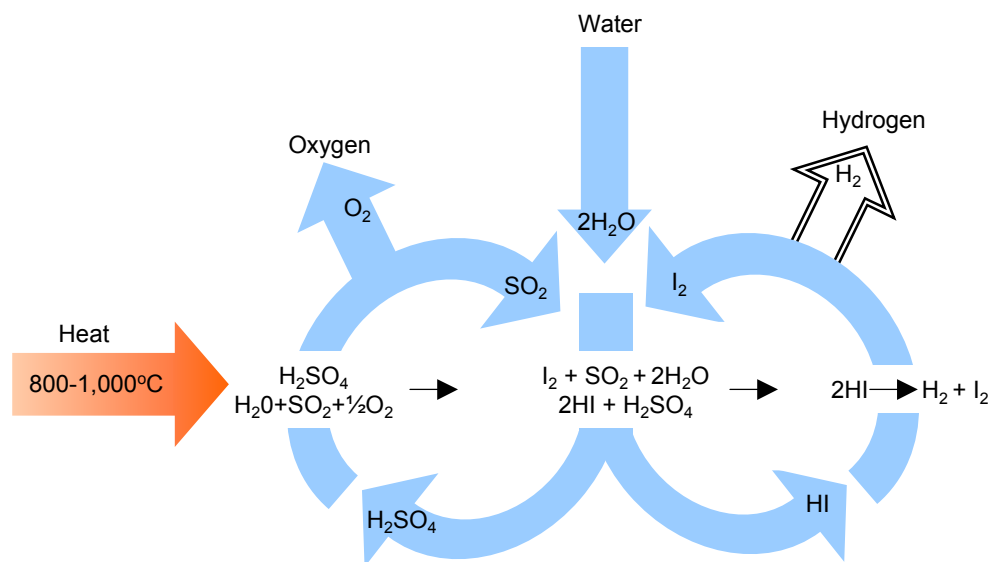
- Expands upon the National Hydrogen Energy Roadmap to define DOE's role in hydrogen R&D
- Presents milestones for hydrogen programs and their integration



The Nuclear Hydrogen Initiative



Goal: Develop advanced hydrogen production technology as part of Next Generation Nuclear Plant (NGNP) to demonstrate economic, commercial-scale hydrogen production.



Advanced Fuel Cycle Initiative

Proliferation-Resistant Nuclear Future

◆ Develop fuel cycle technologies that:

- Enable recovery of the energy value from commercial spent nuclear fuel
- Reduce the toxicity of high-level nuclear waste bound for geologic disposal
- Reduce the inventories of civilian plutonium in the U.S.
- Enable more effective use of the currently proposed geologic repository and reduce the cost of geologic disposal

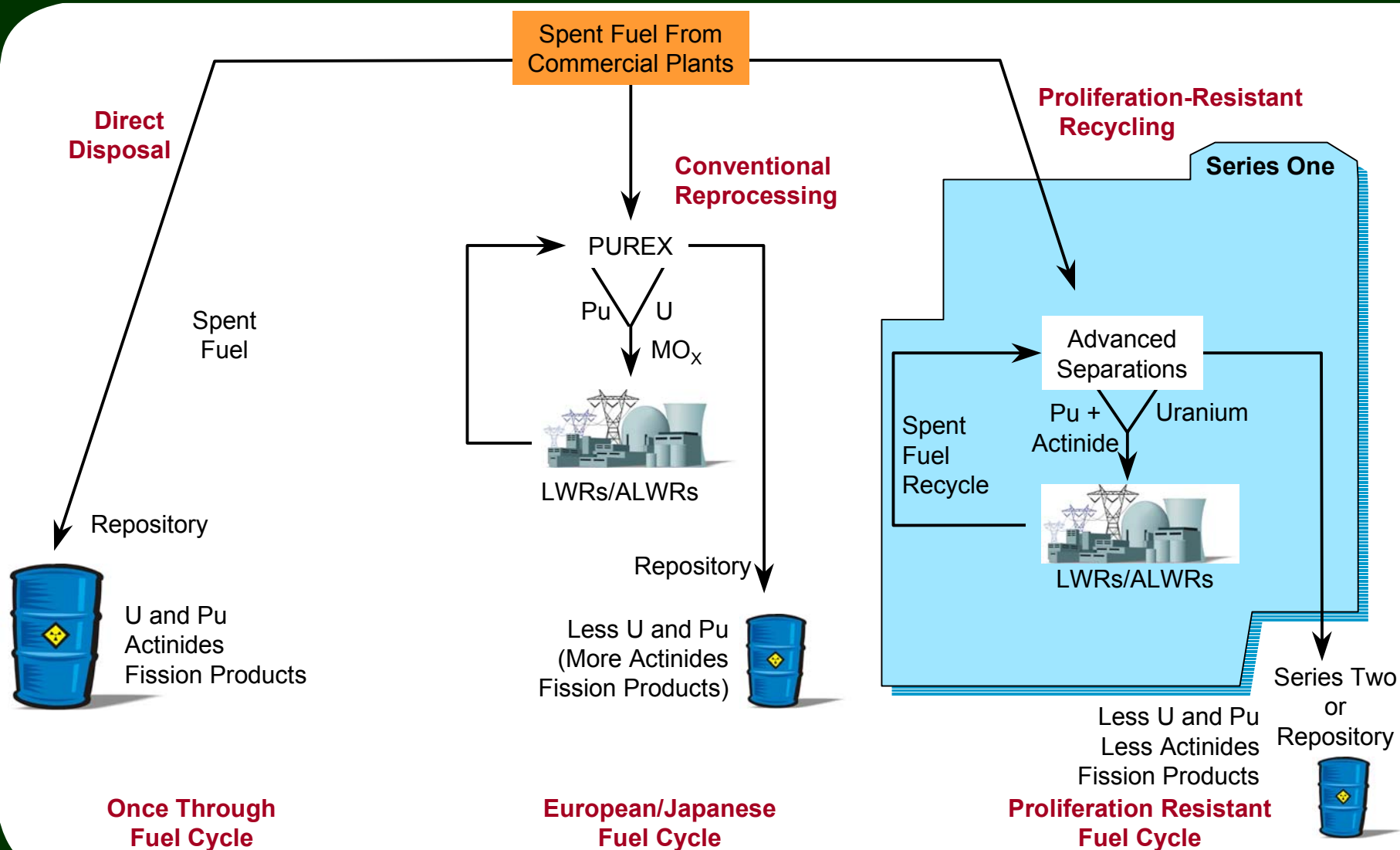
January 2003



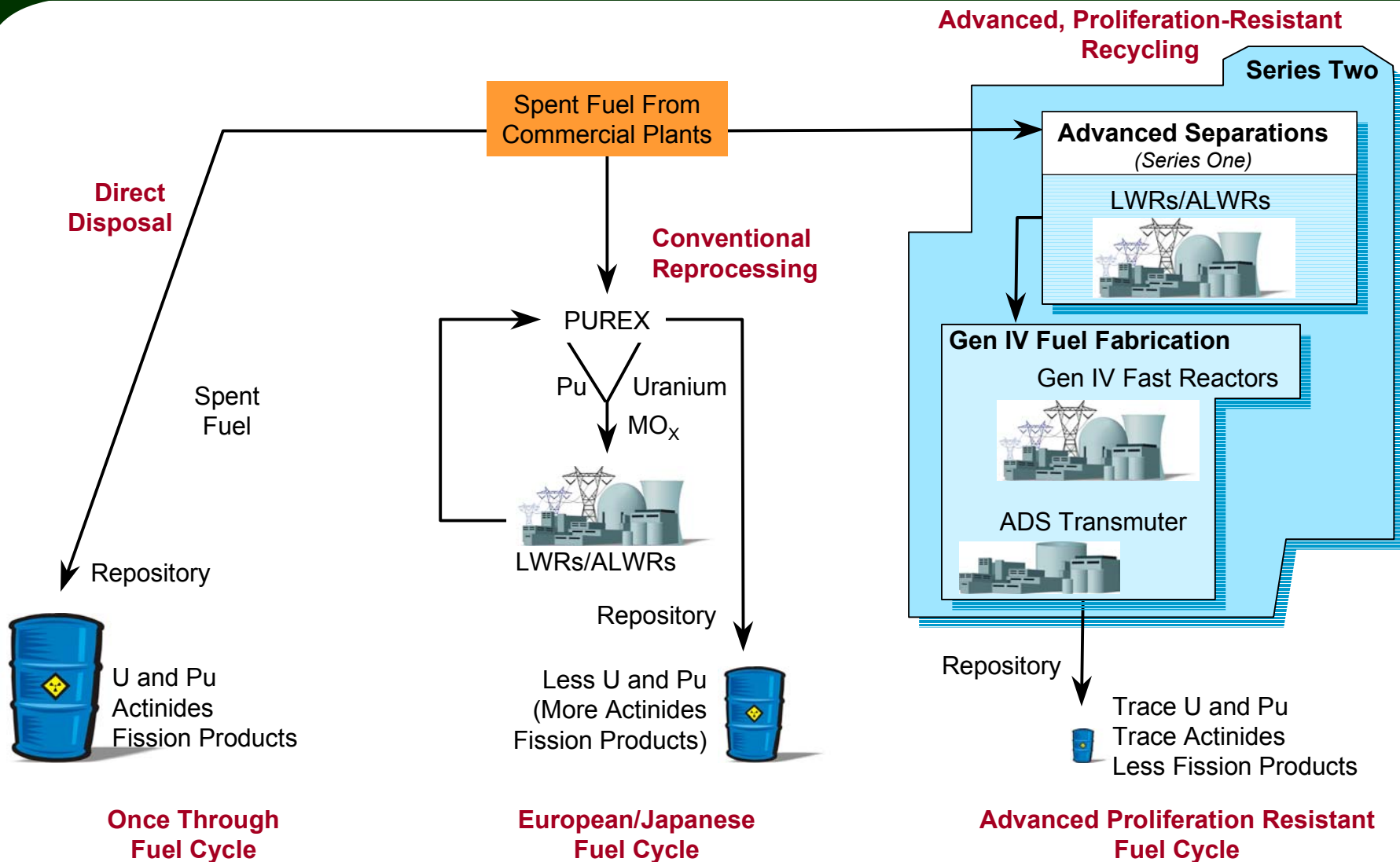
http://www.nuclear.gov/AFCI_RptCong2003.pdf



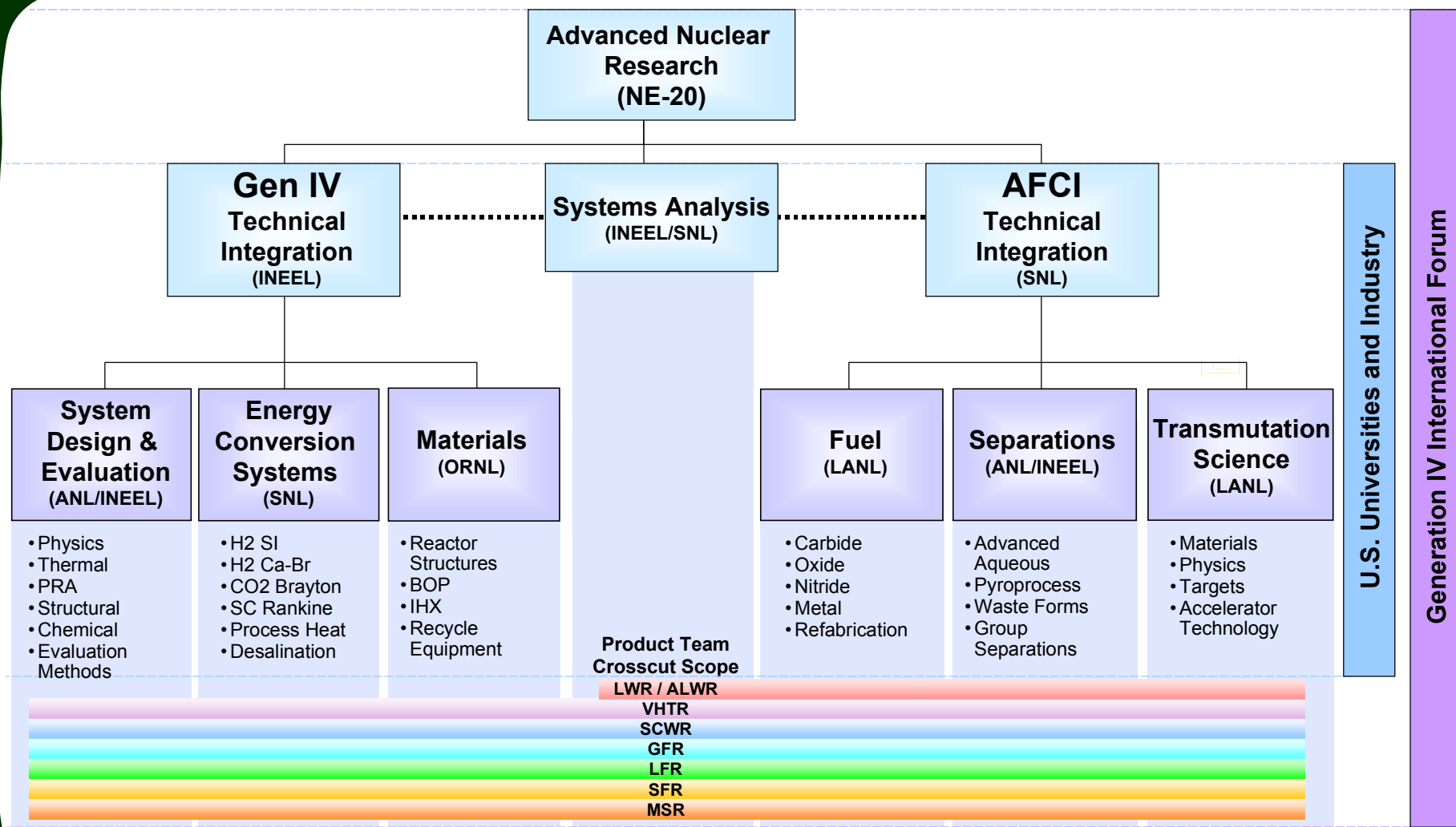
Advanced Fuel Cycle Initiative: AFCI Series One



Advanced Fuel Cycle Initiative: AFCI Series Two



An Integrated Program: *Generation IV and Advanced Fuel Cycle Initiative*



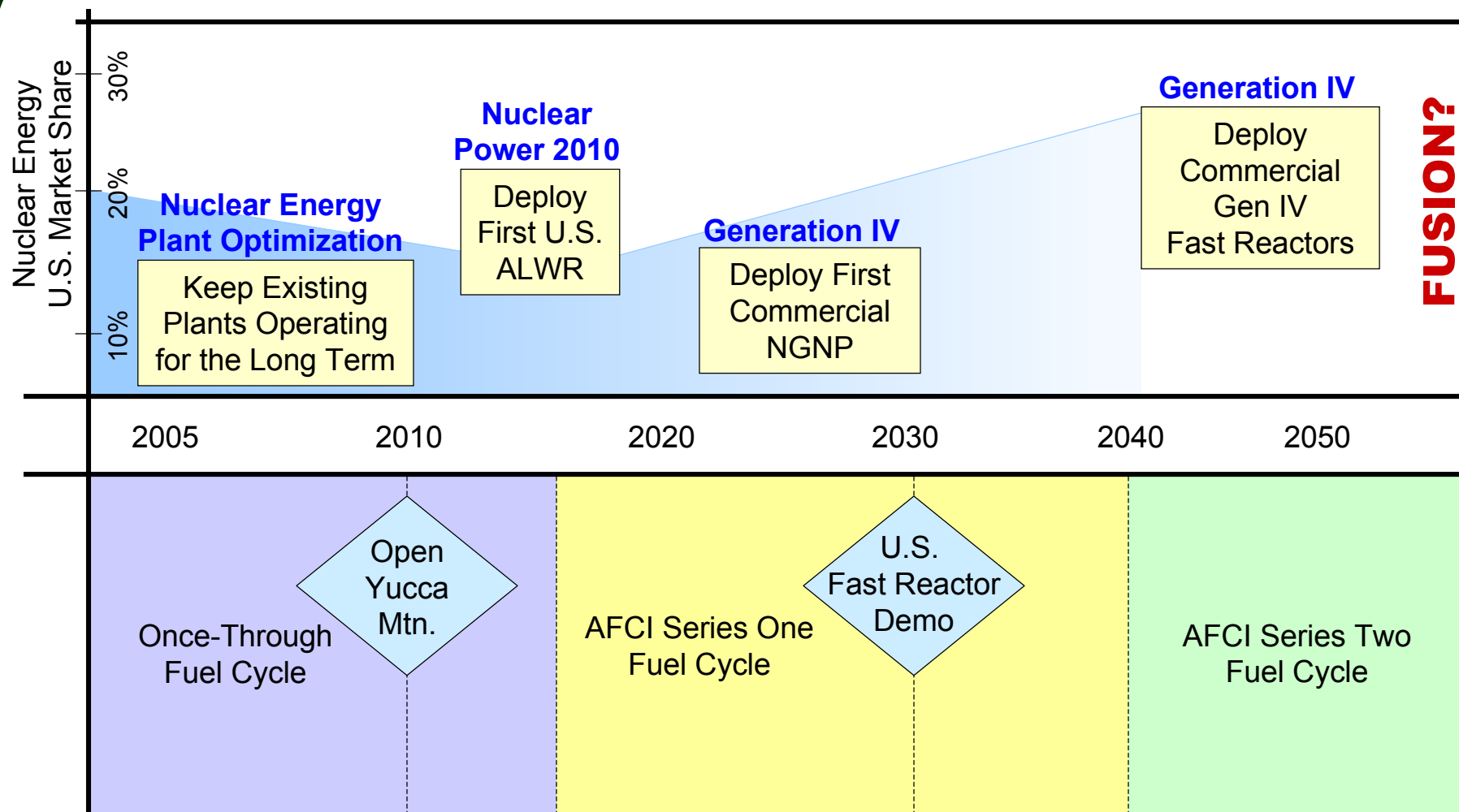
A Renewed Commitment

Potential Role of the University Research Community

- ◆ **Beginning in FY 2004, DOE will devote a fixed percentage of all Nuclear Energy R&D program funding to conduct university research in areas such as:**
 - Innovative fuels and materials
 - Advanced separations technologies
 - Transmutation technologies -- reactors and accelerator-driven systems
 - Computation and modeling capabilities
- ◆ **This is an essential step in assuring a new generation of engineers and scientists for the nuclear future**



A Long-Term Strategy



WWW.NUCLEAR.GOV